REMARKS

The applicants appreciate the Examiner's thorough examination of the application and request reexamination and reconsideration of the application in view of the following remarks.

The Examiner rejects claims 1-9, 20, 25, 26, 31, 32, 42-49, 51-58, 60, 66, 67, 70, 74, and 76-84 under 35 U.S.C. § 102(e) as being anticipated by Digonnet (Publication No. 2004/0061863).

The applicants' claimed photonic crystal interferometric fiber optical gyroscope system as recited in independent claim 1 includes: 1) a light source for providing a primary beam of light, 2) photonic crystal sensing coil having a rotational axis; and 3) a beam controlling device configured to split the primary beam into first and second counter-propagating beams in the photonic crystal sensing coil and configured to direct return of the counter-propagating beams wherein the power of the returning counter-propagating beams represents the phase shift between the counter-propagating beams and is indicative of the rate of rotation of the coil about the rotational axis.

The applicants' claimed photonic crystal interferometric fiber optical gyroscope system includes an improved light source which provides light with an increased spectral width and utilizes a unique photonic sensing coil which includes photonic optical fibers with gas-solid structures that confine light by total internal reflection or bandwidth optical fibers that confine light by employing an optical band gap. The claimed beam controlling device splits light into first and second counter-propagating beams in the photonic crystal sensing coil and directs the return of the counter-propagating beams to the light detector. The light detector measures the power of the first and second counter-propagating beams represents the phase shift between the counter-propagating beams which indicates the rate of rotation of the coil.

As recited in the applicants' specification on page 16, lines 9-34 shown in Fig. 1, the applicants' claimed beam controlled device (20) is configured to split the primary beam into counter-propagating beams (22 and 24) which travel in opposite directions in sensing coil 16, e.g., one beam travels in a clockwise direction and the other beam travels in a counterclockwise direction. The claimed beam controlling device directs the return of the counter-propagating beams to the light detector (60) via the coil splitters (42 and 40). The power caused by the interference of the claimed first and second counter- propagating beams is measured by light detector 60 and represents the phase shift between the first and second counter-propagating beams (e.g., counter-propagating beams 22 and 24). This is indicative of the rate of rotation of photonic crystal sensing coil 16 about rotational axis 18.

In contrast, Digonnet fails to teach, suggest, or disclose a beam controlling device configured to split the primary beam into first and second counter-propagating beams in the photonic crystal sensing coil and configured to direct the return of the counter-propagating beams wherein the power of the returning counter-propagating beams represents the phase shift between the counter-propagating beams that is indicative of the rate of rotation of the coil about the rotational axis. Instead, Digonnet teaches and discloses the use of a phase modulator (38) that is mounted on the optical fiber (13) in the optical path between the fiber loop (14) and the coupler (34). An AC generator (40) drives the phase modulator such that the clockwise propagating wave is not necessarily in phase with the counterclockwise propagating wave. Digonnet further teaches and discloses that the modulation of the light waves must be out phase to introduce a differential phase shift:

> Thus, the modulation of the clockwise propagating wave W1 is not necessarily in phase with the modulation of the counterclockwise propagating wave W2 because corresponding portions of the clockwise wave W1 and the counterclockwise wave W2 pass through the

> phase modulator at different times. Indeed, the modulation of the waves must be out of phase so that the phase modulator 38 provides a means to introduce a differential phase shift between the two waves.

Paragraph 34, emphasis added.

As discussed above, the applicants' photonic crystal interferometric fiber optical gyroscope system with the claimed beam controlling device clearly does not rely on an AC generator to drive a phase modulator such that the first and second counter propagating waves are not necessarily in phase. The claimed beam controlling device also does not rely in any way rely on introducing a differential phase shift between the first and second counter-propagating wave as taught and disclosed by Digonnet.

Moreover, in operation, Digonnet teaches and discloses the output from the AC generator coupled to the phase modulator connected to the optical fiber and the fiber loop sends a signal to the lock-in amplifier (46). This signal provides a reference signal to enable the lock-in amplifier to synchronously detect the detector output signal at the modulation frequency of the phase modulator resulting in the lock-in amplifier acting as a band-pass filter at the fundamental frequency. *See* paragraph 38 of Digonnet. The power of the fundamental frequency provided by the phase modulator is proportional the rotational rate of the fiber loop.

In contrast, as described above, the applicants' claimed beam controlling device splits the primary beam into first and second counter-propagating beams in the photonic sensing coil and directs return of the counter-propagating beams wherein the power of the returning counter-propagating beams represents the phase shift between the counter-propagating beams to provide an indication of the rate of rotation of the coil above the rotational axis.

Accordingly, for the reasons shown above, Digonnet does not teach, suggest, or disclose each and every element of the applicants' claimed photonic crystal interferometric fiber optical

gyroscope system as recited in independent claim 1, namely, a beam controlling device configured to split the primary beam into first and second counter-propagating beams in the photonic crystal sensing coil and configured to direct return of the counter-propagating beams wherein the power of the returning counter-propagating beams represents the phase shift between the counter-propagating beams and is indicative of the rate of rotation of the coil about the rotational axis. Applicants' independent claim 74 includes similar features as claim 1. Accordingly, applicants' independent claims 1 and 74 are patentable and allowable under 35 U.S.C. § 1.02(e) over Digonnet. Because claims 2-9, 20, 25, 26, 31, 32, 42-49, 51-58, 60, 66, 67, 70, and 76-84 depend from allowable base claims, these claims are also allowable and patentable over Digonnet.

The Examiner rejects claims 10-19, 21-24, 27-30, 33-41, 50, 59-66, 68, 69, 71-73, and 75 under 35 U.S.C. § 103(a) as being unpatentable over Digonnet.

As shown above, Digonnet fails to teach, suggest, or disclose each and every element of the applicants' claimed invention as recited in independent claims 1 and 74. Therefore, the Examiner's rejection of dependent claims 10-19, 21-24, 27-30, 33-41, 50, 59-66, 68, 69, 71-73, and 75 is traversed.

The Examiner rejects claims 1-3, 6, 9-32, 39-44, 47-77, and 81 under 35 U.S.C. § 103(a) as being unpatentable over Bergh *et al.* (U.S. Patent No. 4,773,759) in view of DiGiovanni *et al.* (U.S. Patent No. 5,802,236). The Examiner also rejects claims 4, 5, 7, 8, 33-38, 45, 46, 78-80 and 82-84 under 35 U.S.C. § 103(a) as being unpatentable over Bergh *et al.* in view of DiGiovanni *et al.*, and further in view of Allan *et al.* (U.S. Patent No. 6,243,522).

The fiber optic sensors with reduced noise as taught and disclosed in Bergh *et al.* have virtually the same structure and operate virtually the same as the Digonnet reference cited by the

Examiner. *See* Col 6, line 50 - Col. 7, line 35 and Fig. 1 of Bergh *et al.*

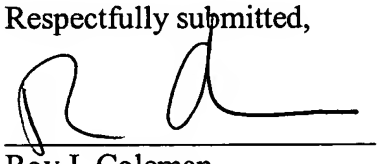
Accordingly, for the same reasons as set forth above, with regard to Digonnet, Bergh *et al.* fails to teach, suggest, or disclose a beam controlling device configured to split the primary beam into first and second counter-propagating beams in the photonic crystal sensing coil and configured to direct return of the counter-propagating beams wherein the power of the returning counter-propagating beams represents the phase shift between the counter-propagating beams and is indicative of the rate of rotation of the coil about the rotational axis. The additional references provided by the Examiner also fail to teach or disclose these features.

Accordingly applicants' independent claims 1 and 74 are allowable and patentable under 35 U.S.C. § 103(a) over Bergh *et al.* in view of DiGiovanni *et al.* Because claims 2-73 and 75-84 depend from allowable base claims, these claims are allowable and patentable under 35 U.S.C. § 103(a) over Bergh *et al.* in view of DiGiovanni *et al.*

Each of the Examiner's rejections has been addressed or traversed. It is respectfully submitted that the application is in condition for allowance. Early and favorable action is respectfully requested.

If for any reason this Response is found to be incomplete, or if at any time it appears that a telephone conference with counsel would help advance prosecution, please telephone the undersigned or his associates, collect in Waltham, Massachusetts at (781) 890-5678.

Respectfully submitted,



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